

ACANTHOCEPHALAN PARASITES:

INVESTIGATION IN PACIFIC MOLE CRABS



FROM THE COASTAL ECOSYSTEM CURRICULUM

FARALLONES MARINE SANCTUARY ASSOCIATION

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Gulf of the Farallones
National Marine Sanctuary

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Acanthocephalan Parasites: Investigation in Pacific Mole Crabs

Objective

Students will investigate the presence of parasites in Pacific mole crabs. Students will learn about the life cycle of a parasite and how it influences organisms in a food web. They will examine the anatomy of sand crabs while using dissection techniques and scientific equipment.

Materials and Supplies for each group

Parasite fact sheet
Student worksheet
Microscope or magnifying glass
2 Petri dishes - 1 for crab, 1 for parasites
Large waste bowl or 100 ml beaker
Squirt water bottle filled with fresh water
Small scissors
2 Tweezers/forceps
Caliper
Gloves

Background

Acanthocephalans (spiny head worms) are parasites that use Pacific mole crabs as their primary intermediate host. In the crabs, the parasites reside in the posterior hemocoel near the midgut. Surf Scoters (diving ducks) are the definitive host (parasite can reproduce) for acanthocephalans, but the parasite affects sea otters as well. Acanthocephalans have caused Surf Scoter die-offs and disease in sea otters by causing peritonitis (inflammation of the abdominal cavity).

Teacher Notes

1. Each class should collect and look for parasites in 30 crabs (> 10 mm). Each group of 2-3 students should dissect 2 crabs.
2. Kill the crabs by placing them in a covered container in a freezer for more than 4 hours. Make sure to note the date and beach where the crabs were collected.
3. This lab will take one class period allowing for introduction, set-up, dissection, entering data, and follow-up questions. Dissecting one crab takes about 10 minutes.
4. You can see the parasites with the naked eye, but using a microscope or magnifying glass will make the identification of the parasites easier.
5. Have the students contain all the crab parts in their large waste bowl, then dispose of all the dead material in a trash can.

A parasite is an organism that grows, feeds, and is sheltered on or in a different organism while potentially harming the host. The organism that the parasite lives with is called a host. The Acanthocephala phylum of spiny-headed worms require two hosts: they live in crustaceans and insects as juveniles, and in the digestive tracts of vertebrates as adults. In the Gulf of the Farallones National Marine Sanctuary, *Profilicollis* species have caused die-offs of Surf Scoters (diving ducks) and could affect the few sea otters living here.



Surf Scoter (*Melanitta perspicillata*)

Life Cycle of Acanthocephala

Some coastal birds are a definitive host for Acanthocephala, meaning that the parasite can reproduce. Birds carry adult parasites in their small intestine where female worms produce eggs, which are passed in the bird's feces. The eggs are eaten by intermediate hosts and the parasite changes into an infective stage called a cystacanth. The definitive host is infected when it ingests an infected intermediate host. The cystacanth excysts in the small intestine and matures into an adult worm. *Profilicollis* species use Pacific mole crabs (*Emerita analoga*) and spiny mole crabs (*Blepharipoda occidentalis*) as intermediate hosts, and Surf Scoters (*Melanitta perspicillata*) as definitive hosts. The parasites affect sea otters (*Enhydra lutris*) as well, but they are a dead-end host because the parasites are not able to reproduce.



Acanthocephalan parasite inside a Pacific mole crab

Effects on Organisms

Pacific mole crabs are the primary intermediate host for Acanthocephalans. In *Emerita analoga* the parasites are located in the posterior hemocoel near the midgut. They look like white footballs, and can be seen by the naked eye. The parasites are not lethal to mole crabs, although they could affect their behavior, perhaps making them easier prey. In both the definitive and dead-end hosts, Acanthocephalans induce peritonitis, which is inflammation around the abdominal cavity. Peritonitis occurs when larval Acanthocephalan parasites that reside in the intestine migrate through the intestinal wall, allowing bacteria to infect the abdominal cavity.

In 1995, the California Department of Fish and Game estimated that 1000-4000 Surf Scoters died due to an unusually high load of Acanthocephalan parasites. Mortality is hindering the growth of the threatened California sea otter population. Forty to fifty percent of sea otter deaths are caused by infectious disease, of which the most prevalent is Acanthocephalan peritonitis. High school students are investigating parasite load as part of sand crab monitoring in the Gulf of the Farallones National Marine Sanctuary.



Sea otter (*Enhydra lutris*)

For more information contact:

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Student Worksheet

Materials and Supplies for each group

Microscope or magnifying glass
2 Petri dishes - 1 for crab, 1 for parasites
Large waste bowl or 100 ml beaker
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Vocabulary Words

parasite
intermediate host
definitive host
hemocoel
peritonitis
excyst



Procedure

1. Measure the carapace length and determine the gender of the crab. Record this information on the data table.
2. With the scissors, cut off the posterior end of the crab, from the notch back (a little bit more than the telson).
3. Cut the crab's carapace up the middle and pry the 2 sides open with your fingers or tweezers.
4. Put the crab in a petri dish and place the petri dish under the microscope. You are now looking at the midgut.
5. You are looking for small white "footballs" that are right under the carapace. You might have to dig around in the gut a little with the tweezers, but if there are parasites they are pretty evident. Flushing the inside of the crab with water using the squirt bottle can help find parasites. Make sure you keep pulling out the insides of the crab to thoroughly check the whole gut area for parasites.
6. Remove the parasite(s) and place them in a petri dish filled with fresh water. The parasite will excyst after a few minutes. Look at the head end - it should have spines.
7. Record the number of parasites on the data table. It is just as important to record zeros as crabs with parasites!

Data Table

Date	Beach	Size (mm)	Gender (F, FE, M)	Number of Parasites

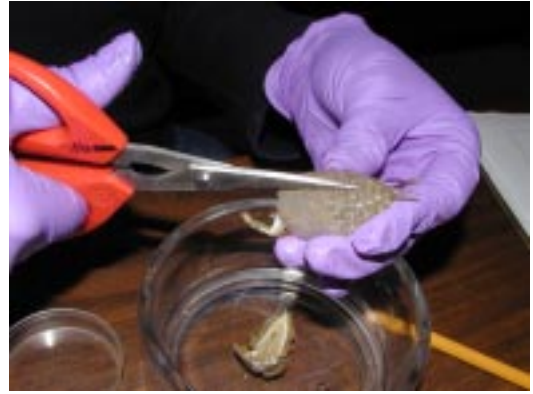
Questions

1. What did you observe while dissecting and looking for parasites?
2. After comparing your data with your classmates, what trends do you notice?
3. How do acanthocephalan parasites affect other organisms?
4. How could you determine what is a harmful level of parasites?

Dissection Steps



1. Record the size and gender for each crab on the data table.



2. After cutting off the telson, cut the carapace up the middle.



3. Pull apart the sides of the carapace to expose the midgut.



4 Look initially to see if you can see small white parasites inside.



5. Flushing the inside of the crab with water and digging around with your forceps will help you locate all the parasites.



6. The parasites look like small white footballs. Record how many parasites you found for each crab on the data table.



7. When the parasites are in fresh water, they excyst after a few minutes.